

WHAT IS CLAIMED IS:

1. A system for displaying electrophysiology data from a patient's heart, said heart including a heart chamber, to a user, said system comprising:

5 a set of passive electrodes located within said heart;

a set of active electrodes located within said heart;

10 a pulse generator coupled to said set of active electrodes for creating and applying an electric field within said heart;

15 a signal digitizer coupled to said set of passive electrodes for generating a numerical representation of electric field strength at each of said set of passive electrodes, generating a set of measured potentials;

20 a signal conditioner for extracting from said measured potentials a map representation of the interior surface of said heart, and for extracting from said measured potentials a representation of said intrinsic electrical activity of said heart chamber;

display means for displaying said representation of said electrical activity on said map representation.

25 2. The system of claim 1 wherein said map representation is a dynamic representation reflecting

motion of said heart chamber over time.

3. The system of claim 1 wherein said map representation is a representation reflecting a static
5 position of said heart chamber in time.

4. The system of claim 1 wherein said passive electrodes are located on a basket,
10 said basket located on the distal end of a catheter;

said basket having a plurality of conformal fingers in engagement with said heart chamber.

5. The system of claim 4 wherein said active
15 electrodes are located on said catheter proximate said passive electrodes.

6. The system of claim 1 wherein said passive electrodes are located proximate a balloon;
20 said balloon located on the distal end of a catheter.

7. The system of claim 6 wherein said active electrodes are located on said catheter proximate said
25 passive electrodes.

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8. The system of claim 1 wherein said signal conditioner extracts said map representation from said intrinsic electrical activity of said heart from said measured potentials in the frequency domain by filtering
5 said measured potentials.

~~SYSTEM~~ A system for measuring electrophysiologic potentials within a heart and displaying endocardial electrophysiologic potentials to a user comprising:

10 a set of passive measurement electrodes located on a first catheter;

a set of active interrogation electrodes located on a first catheter;

15 a signal digitizer coupled to said set of passive measurement electrodes for generating a numerical representation of electric field potentials at each of said set of passive electrodes;

20 a pulse generator coupled to said active interrogation electrodes for generating an interrogation electric field at a first frequency;

a signal digitizer coupled to said passive measurement electrodes for converting electric field potentials at said set of passive measurement electrodes to a set of wall distance measurement values

25 representing the perturbation of said interrogation

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electric field by the walls of said heart;
said signal digitizer for converting
electrophysiologic signals to a set of activity
measurements representing the electrical activity of
5 said heart;
convertor means for generating a graphic
representation of an endocardial surface from said wall
distance measures;
convertor means for generating a display of said
10 activity measurements on said representation of said
endocardial surface.

10. The system of claim 9 further including:
a set of locator electrodes located on a second
15 catheter, said second catheter located in said heart
chamber;
a pulse generator coupled to said locator
electrodes for generating electric field;
a signal digitizer coupled to said passive
20 measurement electrodes for converting electric field
potentials at said set of passive measurement electrodes
to a set of distance measurement values representing the
location of said set of locator electrodes within said
heart;
25 convertor means for generating a representation of the

position of said locator electrodes (on said representation of said endocardial surface) within said heart chamber.

5 11. The system of claim 10 wherein said convertor means generates a representation of the position of said locator electrodes on said representation of said endocardial surface.

10 12. A system for measuring, and displaying electrophysiologic potentials arising within a patient's heart, and for indicating the location of a catheter within a patient's heart comprising:

15 a set of passive electrodes positioned on a probe catheter within said heart;

 a set of active interrogation electrodes, positioned in a known relationship with respect to said passive electrodes;

20 a set of locator electrodes positioned on a movable therapy catheter;

 a therapy delivery mechanism positioned on said movable therapy catheter;

25 an therapy pulse generator coupled to said interrogation electrodes for generating an interrogation electric field;

a locator pulse generator coupled to said set of locator electrodes for creating a locator electric field, indicative of the relative location of said catheter, with respect to said passive electrodes;

5 signal processor and digitizer coupled to said passive electrodes for converting interrogation field potentials at said set of passive electrodes to a set of distance measurement values representing the perturbation of said interrogation field by the walls of
10 said heart;

said signal processor and digitizer for converting electrophysiologic signals to a set of activity measurements representing the electrical activity of said heart;

15 said signal processor and digitizer for converting locator signals to a set of position measurements representing the location of said movable therapy catheter;

convertor means for generating a graphic
20 representation of an endocardial surface from said distance measures;

convertor means for generating a display of said activity measurements on said representation of an endocardial surface;

25 convertor means for generating a display of said

locator electrode location with respect to said graphic representation within the chamber volume.

13. The device of claim 12 wherein said locator
5 pulse generator and said interrogation pulse generator
operates sequentially at different times.

14. The device of claim 12 wherein said locator
pulse generator and said interrogation pulse generator
10 operate simultaneously at different frequencies.

15. The device of claim 13 wherein said locator
pulse generator and said interrogation pulse generator
operate at frequencies which are integer multiples.

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16. The device of claim 14 wherein said locator
pulse generator operates at forty eight hundred hertz.

17. The device of claim 14 where said
20 interrogator pulse generator operates at twenty four
hundred hertz.

18. A therapy catheter comprising:
a lead body having a distal end and having a
25 proximal end;

a locator electrode proximate said distal end;
a set of therapy electrodes located proximate said
distal end.

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~~19.~~ A therapy catheter comprising:

a lead body having a distal end and having a
proximal end;
a locator electrode proximate said distal end;
a drug delivery lumen located proximate said
10 distal end.

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~~20.~~ A therapy catheter comprising:

a lead body having a distal end and having a
proximal end;
a locator electrode proximate said distal end;
a microwave wave guide coupled to said distal end
for directing microwave energy to an ablation site.

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~~21.~~ A therapy catheter comprising:

a lead body having a distal end and having a
proximal end;
a locator electrode proximate said distal end;
a fiber optic cable coupled to said distal end for
directing laser energy to an ablation site.

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22. A therapy catheter comprising:
a lead body having a distal end and having a
proximal end;
a locator electrode proximate said distal end;
5 an angioplasty balloon coupled to said distal end
for opening a stenotic lesion in a coronary vessel.

23. A system for measuring and displaying
electrophysiologic signals originating in a patient's
10 heart, to an observer, said system comprising:
an active electrode set located within said
patient's heart;
a passive electrode set located within said
patient's heart in a known physical relationship with
15 said active electrode set, defining a set of passive
electrode sites;
an electric field generator coupled to said active
electrode set for generating an oscillating electric
field around said passive electrode sites;
20 a signal conditioner coupled to said passive
electrode set for extracting low frequency
electrophysiologic measurements from said passive
electrode sites, generating a electrophysiologic
activity measurement data set, and for extracting
25 geometric information from said oscillating electric

field as measured at said passive electrode sites;
a wall surface representation generator for
creating a pictorial representation of the interior wall
of said patient's heart from said interrogation field
5 measured at said passive electrode sites.

24. ~~A system for measuring and displaying
electrophysiologic signals originating in a patient's
heart to an observer, said system comprising:~~

10 an active electrode set located within said
patient's heart;

a passive electrode set located within said
patient's heart in a known physical relationship with
said active electrode set, defining a set of passive
15 electrode sites;

an electric field generator coupled to said active
electrode set for generating an oscillating electric
field around said passive electrode sites;

a signal conditioner coupled to said passive
20 electrode set for extracting low frequency
electrophysiologic measurements from said passive
electrode sites; generating a electrophysiologic
activity measurement data set, and for extracting
geometric information from said oscillating electric
25 field as measured at said passive electrode sites;

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wall electrogram generator for creating a display
of electrophysiologic activity measurement data to said
observer.

- 5 25. A system for measuring and displaying
electrophysiologic signals originating in a patient's
heart to an observer, said system comprising:
 an active electrode set located within said
patient's heart;
- 10 a passive electrode set located within said
patient's heart in a known physical relationship with
said active electrode set, defining a set of passive
electrode sites;
- an electric field generator coupled to said active
15 electrode set for generating an oscillating electric
field around said passive electrode sites;
- a signal conditioner coupled to said passive
electrode set for extracting low frequency
electrophysiologic measurements from said passive
20 electrode sites, generating a electrophysiologic
activity measurement data set, and for extracting
geometric information from said oscillating electric
field as measured at said passive electrode sites;
- site electrogram generator for creating a time
25 series display of electrophysiologic data from a heart

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wall location designated by said observer.

26. A process for measuring electrophysiologic data in a heart chamber comprising the steps of:
- 5 (a) positioning a set of passive electrodes within a patient's heart;
- (b) positioning a set of active electrodes within a patient's heart;
- (c) supplying oscillating current to said set of
- 10 active electrodes thereby generating an electric field in said heart chamber;
- (d) detecting said electric field at said passive electrode sites, generating a set of electric field measurement data;
- 15 (e) extracting in the frequency domain, from said field measurement data, that component of said field measurement data corresponding to chamber geometry and generating chamber geometry data;
- (f) extracting in the frequency domain, from said field measurement data, that component of said field measurement data corresponding to the underlying intrinsic electrophysiologic activity of the heart chamber, and generating electrophysiology data;
- 20 (g) graphically displaying said chamber geometry data;
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(h) graphically displaying said electrophysiologic data.

27 A process for measuring electrophysiologic
5 data in a heart chamber comprising the steps of:

(a) positioning a set of passive electrodes within patient's heart;

(b) positioning a set of active electrodes within a patient's heart;

10 (c) supplying oscillating current to said set of active electrodes thereby generating an electric field in said heart chamber;

(d) detecting said electric field at said passive electrode sites, generating a set of field measurement
15 data;

(e) extracting in the time domain, from said field measurement data, that component of said field measurement data corresponding to the underlying electrophysiologic activity of the heart chamber, and
20 generating electrophysiology data;

(f) graphically displaying said chamber geometry data;

(g) graphically displaying said electrophysiologic data.

28. A process for determining and displaying the location of a therapy catheter in a heart chamber comprising the steps of:

- (a) positioning a set of passive electrodes
5 within said heart chamber;
- (b) positioning a set of active locator electrodes within said heart chamber, said locator electrodes being positioned on a therapy catheter;
- (c) supplying oscillating current to said set of
10 active locator electrodes thereby generating an electric field in said heart chamber;
- (d) detecting said electric field at said passive electrode sites, generating field measurement data;
- (e) extracting in the frequency domain, from said
15 field measurement data, that component of said field measurement data corresponding to locator electrode location and generating location data;
- (f) graphically displaying said location data.

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